

## **REMARKS**

### **Summary of Examiner's Interview**

The Applicants' Attorney thanks Examiner Pascal for the interview of December 9, 2008.

During the interview, the Applicant's Attorney and Examiner Pascal discussed Japanese Patent Application No. 56082382, which was published on April 12, 1982 as Publication Number 57197934 A. It was agreed that the Applicants would submit a Supplemental Response that distinguishes the pending claims from Japanese Patent Application No. 56082382.

### **Pending Claims**

Claims 1-48 are pending. Claims 5, 31-37, and 46 have been withdrawn.

### **Japanese Patent Application No. 56082382**

Japanese Patent Application No. 56082382 to Okada Keikichi (hereinafter "the Keikichi patent application") describes a radio transmitter and receiver with a common antenna that includes a bi-directional interface with a directional coupler that provides isolation between the transmitter 12 and the receiver 13. Directional couplers are passive devices that are strictly reciprocal devices. That is, the coupling coefficient in a directional coupler is the same in both directions. For example, if 90% of the transmission signal generated by the transmitter 12 couples from the subordinate transmission line 35 to the main transmission line 34, then 90% of the received signal couples from the main transmission line 34 to the subordinate transmission line 35. The performance of a bi-directional interface with a directional coupler is constrained by reciprocal nature of the directional coupler. More specifically, a bi-directional interface with a directional coupler cannot achieve both high transmit efficiency and high receive sensitivity

because the coupling coefficient in the directional coupler is the same in both directions. For example, if the bi-directional interface shown in the Keikichi patent application with a directional coupler was designed to maximize transmission efficiency, the coupling coefficient from the subordinate transmission line 35 to the main transmission line 34 should be as close to one as possible. However, if the coupling coefficient between the subordinate transmission line 35 and the main transmission line 34 is close to one, substantially all of the received signal in the main transmission line 34 would couple to the subordinate transmission line 35. Therefore, very little of the received signal will reach the receiver 13, so the receiver sensitivity will be very low.

Similarly, if the bi-directional interface shown in the Keikichi patent application with a directional coupler was designed to maximize receiver sensitivity, the coupling coefficient between the main transmission line 34 and the subordinate transmission line 35 would be as close to zero as possible. However, if the coupling coefficient between the main transmission line 34 and the subordinate transmission line 35 is essentially zero, then the transmission efficiency would be very low because very little of the transmission signal generated by the transmitter 12 would be transmitted through the antenna 11.

In contrast, the bi-directional interface of the present invention is an active device that is non-reciprocal. The coupling coefficient in one direction is not equal to the coupling coefficient in the other direction. In the bi-directional interface of the present invention, substantially all of the RF transmission signal is passed to the RF bi-directional port. In addition, in the bi-directional interface of the present invention, at least some of the received RF reception signal couples from the first waveguide to the second waveguide and to an output of the interface where

it can be received by a receiver. Thus, with the bi-directional interface of the present invention,  
the transmit efficiency is independent of the receiver sensitivity.

The pending claims distinguish bi-directional interfaces that use directional couplers because the pending claims all recite a non-reciprocal device or method of non-reciprocal coupling where the coupling between the first waveguide and the second waveguide is dependent on the direction of coupling. For example, independent claim 1 as currently amended recites a signal interface wherein substantially all of the RF transmission signal is passed through the first waveguide to the RF bi-directional port, while a portion of the received RF reception signal couples from the first waveguide to the second waveguide. As described above, such signal interfacing is not possible with a reciprocal device, such as the directional coupler described in the Keikichi patent application.

Similarly, independent claim 11 recites a method of interfacing a reception signal that recites coupling a portion of the traveling-wave RF reception signal propagating in the second direction from the first waveguide to the second waveguide in a substantially non-reciprocal manner. Also, independent claim 47 recites a means for propagating a traveling-wave transmission signal in a first direction to a bi-directional port without coupling a significant portion of the traveling-wave transmission signal to a second waveguide; and a means for coupling a traveling-wave reception signal propagating in the second direction from the first waveguide to the second waveguide. Such a combination of elements is not possible with a reciprocal device, such as the directional coupler described in the Keikichi patent application.

Other independent claims recite an electro-optic bi-directional interface or a method of transmitting and receiving signals that includes modulating the optical beam. These claims

include an electro-optic device or method of modulating that is not described in the Keikichi patent application.

Thus, the Applicants believe that the pending claims are not anticipated or rendered obvious by the Keikichi patent application because the Keikichi patent application describes a bi-directional interface with a directional coupler that provides reciprocal coupling.

### **Conclusion**

The Applicants respectfully request reconsideration of the pending claims in light of the arguments presented in the October 8, 2008 Response, the Supplemental Amendment filed on November 30, 2008, and the present Supplemental Response. The Applicants respectfully request rejoinder of the withdrawn claims upon allowance of independent claim 1.

The undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Respectfully submitted,

Date: December 15, 2008

Reg. No. 40,137

Tel. No.: (781) 271-1503

Fax No.: (781) 271-1527

/Kurt Rauschenbach/

Kurt Rauschenbach, Ph.D.

Attorney for Applicant

Rauschenbach Patent Law Group, LLC

Post Office Box 387

Bedford, MA 01730